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245

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by

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ABSTRACT

Tree cutting and branch pruning in a 30-year-old stand of lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.) in Colorado halved the number of trees infected with dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm). Further studies are needed, but these results suggest that pruning may be feasible in marginally stocked stands to save trees needed for stocking.

INTRODUCTION

Lodgepole pine dwarf mistletoe is the most widely distributed dwarf mistletoe in North America (Hawksworth and Wiens 1972). In Colorado and Wyoming lodgepole pine stands heavily infested with mistletoe have about half the volume and twice the mortality rate of non-infested stands on comparable sites (Hawksworth 1958).

The disease is most commonly controlled through silvicultural methods aimed at reducing the number of dwarf mistletoe seeds that can spread the disease. This objective is accomplished by cutting infected trees. Another method is to prune out infected branches (Perry 1922; Weir 1923). In addition to removing the source of dwarf mistletoe seeds, pruning improves tree vigor and longevity by removing the primary site of tree growth loss -- parasitized branches (Lightle and Hawksworth 1973). Past studies have been mainly concerned with pruning dwarf mistletoe infected ponderosa pine. Additional information is needed for other host and mistletoe species. In 1966, a study was established in northcentral Colorado to test the feasibility of pruning infected lodgepole pine in order to maintain stocking and carry the stand to rotation. The only alternative in many cases would be to harvest the stand and start over. A second purpose for the study was to collect cost figures on pruning for disease control.

METHODS AND MATERIALS

Pre-treatment Description of Stand

A 20-acre stand of 30-year-old lodgepole pine near Hidden Lakes in the North Park Ranger District, Routt National Forest, was selected as the study area. The stand was thinned to 15-by 15-foot spacing in 1962, but unfortunately with little regard for control of dwarf mistletoe. The residual stand in 1966 averaged 194 trees per acre of which 151 (78 percent) were infected.

All lodgepole pines were examined and assigned to one of three treatment categories:

Nonpruned: trees visibly free of dwarf mistletoe to be left nontreated.

Figure 1. Pruned and non-pruned lodgepole pine and understory trees at the Hidden Lakes study site in 1972.

Pruned: infected trees that would still have half their live crown if pruned up to the highest visibly infected branch, plus two complete whorls. Trees meeting these requirements could also have infections on the lower half of the stem, since this type of infection is not an important source of seed and apparently does not affect growth of trees (Walters 1974).

Cut: all other infected trees, including those with infections on the upper half of the stem, to be cut down.

The entire stand was treated once according to the criteria described above. Treatment cost was $30 per acre, or an average of $0.15 each for trees in all categories. No other cost data were obtained from the study.

Post-treatment Description of Stand

During 1972 and 1972, all residual trees 10 feet or more in height were counted and examined for mistletoe infection and d.b.h., total height, pruned height, height of stem infections, and height and number of branch infections were recorded for each pruned tree. Number of infections per tree were also recorded for nonpruned trees. A ladder was used so the observer could carefully examine the crown. The same observers examined all trees.

A comparison of the stand before and after treatment is summarized in Table 1.

Table 1 Comparison of pre-treatment and post-treatment levels of dwarf mistletoe infection in pruned and nonpruned lodgepole pine.

Treatment and date	Trees per acre (number)	Infected (percent)
Pre-treatment (1966)	194	78
Post-treatment (1971-72)		
pruned	19	54
nonpruned	43	26
Post-treatment Totals	62	35

As indicated in Table 1, 54 percent of the pruned trees and 26 percent of the nonpruned trees were visibly infected. The average number of infections per infected tree (2.9) was the same for both pruned and nonpruned trees. The average height of pruned stem above ground level (8.9 feet) was about 40 percent of the average tree height. Average d.b.h. for pruned trees was 5 inches. Only 8.8 percent of the pruned trees had stem infections. Trees with stem infections may or may not have had any branch infections. Only three pruned trees had more than one stem infection.

Eighty-two percent of the branch infections were in the lower 2 feet of the live crown, and 91 percent in the lower 3 feet (Table 2).

Table 2 The distribution of 564 dwarf mistletoe branch infections in 377 pruned lodgepole pine 6 years after pruning.

Height from bottom of live crown (feet)	Infections (percent)
0 - 1.0	60
1.1 - 2.0	22
2.1 - 3.0	9
over 3.1	9

None of the trees were killed by dwarf mistletoe. Regeneration was present in open areas of the stand (Figure 1).

RESULTS AND DISCUSSION

Thinning and pruning reduced the percentage of infected trees by more than half, and almost half of the pruned trees were visibly free of dwarf mistletoe 6 years later. Pruning, in this instance, was a useful method for retaining and improving the quality of the stocking. The estimated dwarf mistletoe rating (Hawksworth 1977) for all trees after thinning averaged less than 1.0 on a scale of 0 to 6. This rating indicates a low level of disease intensity.

Even though the stand in this study was understocked, similar results should be obtainable in adequately stocked stands. Eighty-two percent of the remaining branch infections were found in the lower 2 feet of live crown; possibly more of the pruned trees would have been free of dwarf mistletoe if one or two additional branch whorls were removed at the time of pruning.

The subsequent appearance of infections on pruned and nonpruned trees after treatment may be a result of carelessness in detecting the disease, failure of the field workers to adhere to pruning standards or difficulty in detecting latent infections. The recurrence of infections emphasizes two principles established in other studies (Lightle and Hawksworth 1973; Shea and Lewis 1971): it is not practical to eradicate the disease from a stand; second, followup treatment is necessary to detect latent infections and for continued suppression of the disease. Continued suppression may not, however, always be needed.

Even though pruning of infected trees is not practiced in timber management units in Colorado, the results of this study suggest that it may be practical in certain cases to save trees that are needed for stocking. More information is needed to determine the types of stands where pruning may be feasible and the number of recleanings required. For example, a single cleaning may reduce the parasite to such low levels that no further effort is needed until the first commercial thinning. Pruning may be justified on high value trees such as those found in recreation units or around administrative sites (Lightle and Hawksworth 1973). This practice would improve the general vigor and longevity of valuable trees.

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